TITLE OF THE INVENTION

Digital Cordless Telephone Home Network

BACKGROUND OF THE INVENTION

[0001]   This application claims the benefit of U.S. Provisional Application No. 60/193,403, filed March 29, 2000.

1.   Field of the Invention

[0002]   This invention relates in general to wireless digital communications. In particular, the invention relates to a wireless digital networking system for the home.

2.   Background Art

[0003]   Cordless telephones have become increasingly popular in recent years, such that they are now a common fixture in the modern household. The functionality of cordless telephones has typically been adapted to voice telephony functions, such as the conduction of voice telephone calls, answering machine services and speciality functions such as Caller ID. Thus, digital data capabilities are typically limited to DTMF keypad signalling, rather than general purpose digital data communications.

[0004]   Accordingly, cordless telephones have become a relatively high volume, low cost product choice for voice communications, sold through an enormous array of consumer outlets. Moreover, cordless telephones are very price-sensitive products. Due to an absence of common subsidization models enabling a recurring service-based revenue stream to offset the cost of cordless telephone hardware, cordless telephones

must generate profits based upon hardware sales alone. Thus, cordless telephone product lines are typically directed to offering the user multiple products with varying features, such that the consumer pays only for desired features. While with the advent of the Internet age there are many new business models that do enable hardware subsidization through subscription and/or advertising revenues, these models have not been widely applied to conventional cordless telephones, and are oftentimes disadvantageous because such models complicate the consumer's purchasing decision.

[0005]   Nevertheless, modern digital cordless telephones are high-volume, low cost products commonplace in modern homes that support wireless digital communications -- often with substantial bandwidths. Thus, it may be desirable to define a low-cost wireless digital network based upon a cordless telephone system. It may further be beneficial in some applications to support additional hardware features through expandability and upgradability, thus keeping the consumer purchase decision relatively simple.

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SUMMARY OF THE INVENTION

[0006]   A wireless digital communications network is presented that includes a cordless telephone base unit. The base unit incorporates a radiofrequency transceiver capable of establishing wireless digital communication links, a microprocessor circuit, digital storage accessible to the microprocessor circuit, and a telephone line interface that can be connected to a public switched telephone network ("PSTN"). A cordless telephone handset is provided to conduct voice telephone calls on the PSTN. Furthermore, additional electronic devices include RF transceivers capable of communicating digital data according to the cordless telephone communications protocol implemented by the base unit. The base unit, handset and additional devices include unique identification number by which communications can be specifically addressed thereto. Each of these devices may also incorporate encryption mechanisms for securing their respective data communications.

[0007]   The base unit can include a communications port through which communications with a separate digital network, such as the Internet, can be established. For example, this communications port may consist of a Digital Subscriber Line ("DSL") modem, through which the base unit can access the Internet or another server. In accordance with one potential aspect of the invention, the communications port may be implemented as an expansion module that can be readily installed into the base unit, as desired, thus allowing for flexible hardware configurations and upgradability. Thus, other types of communications ports can be installed as desired by the user, such as a cable modem, analog data modem for a second PSTN line, wireless ethernet modem, etc.

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[0008] Any additional electronic devices on the network can utilize the network access resources of the base unit. For example, a PDA equipped with a transceiver capable of communicating with cordless telephone base unit 100 can initiate communication links through which data can be transmitted to and received from the Internet. Such additional electronic devices can also access information storage capabilities of the base unit, thereby enabling the reading and updating of email messages or a master grocery list maintained within the base unit. Additional electronic devices with audio input and output capabilities can also use the wireless interface with base unit 100 to conduct voice telephony via the PSTN. Moreover, a user can utilize the handset or an electronic device to conduct voice telephony via base unit 100, while simultaneously using another electronic device to engage in data communications via the Internet.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]   Figure 1 is a block diagram of the digital cordless telephone home network.

[0010]   Figure 2 is a schematic block diagram of the network base unit.

DETAILED DESCRIPTION OF THE DRAWINGS

[0011] While this invention is susceptible to embodiment in many different forms, there are shown in the drawings and will be described in detail herein several specific embodiments. The present disclosure is to be considered as an exemplification of the principle of the invention intended merely to explain and illustrate the invention, and is not intended to limit the invention in any way to embodiments illustrated.

[0012] A wireless home network arrangement according to the present invention is illustrated in Figure 1. The network is centered upon cordless telephone base unit 100. Base unit 100 communicates with cordless telephone handset 110 via a multiple-access digital communications protocol. Many such protocols are known in the cordless telephone art, including DECT, WDCT, and CT2. Alternatively, other digital wireless communications protocols, such as those designed for data communications, can also be utilized for the conduction of telephone calls between handset 110 and base unit 100.

[0013] Base unit 100 is also capable of communicating with numerous other devices via the selected wireless digital communications protocol, thereby enabling it to serve as the hub of a wireless home network. For example, the network depicted in Figure 1 includes communications with personal computer 120, laptop computer 130, television appliance 140, portable display 150, refrigerator 160, PDA 170 and home security system 180. Each device on the home network is assigned a unique device ID, thereby allowing for addressable communications between base unit 100 and each of the devices on the wireless network, 110 through 180.

[0014] Figure 2 is a schematic block diagram of one embodiment of base unit 100. Digital signals are received and transmitted between base unit 100 and various

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components of the wireless network 110 through 180 by radiofrequency transceiver 200. Within base unit 100, the digital signals are bidirectionally communicated between transceiver 200 and central microprocessor circuit 210. Memory 220 is accessible to microprocessor circuit 210 and is provided to implement a number of functions, such as the storage of operational program code for microprocessor circuit 210, the storage of answering machine outgoing message data and incoming messages, and the storage of information as required by various specific features implemented by the user (e.g. email outbox and inbox, grocery list, etc.). Accordingly, memory 220 may be comprised of one or more types of digital storage known in the art, as may be desired for various functions, such as DRAM, SRAM, EEPROM, and/or magnetic media. Telephone line interface 230 is provided to allow for, at a minimum, the implementation of voice telephony between telephone handset 110 and public switched telephone network ("PSTN") line 232.

[0015]   Base unit 100 is also provided with expansion slots 242 through 248. The expansion slots provide for a highly flexible system which can be configured to meet a customer's current needs and provide for future upgradability, without requiring the purchase of unnecessary or unwanted hardware. For example, for some users it may be desirable to provide for communications between home network base unit 100 (and optionally various devices connected thereto) and the Internet. Thus, expansion module 244 is provided as a Digital Subscriber Line ("DSL") modem, allowing for communications between base unit 100 and DSL line 245. Alternatively, a user could select an expansion module designed to provide a different type of connection to the Internet or any other separate digital network. For example, a cable modem module could be provided if the user subscribes to cable modem service. If a user utilizes a second PSTN line for data

communications via an analog modem, an analog modem module could be provided for interconnection thereto. Some Internet Service Providers ("ISPs") require the use of proprietary modem units; thus, expansion module 244 may comprise an Ethernet or Universal Serial Bus communications port, as is required for interconnection with the ISP's particular modem unit.

[0016]   Microprocessor circuit 210 may utilize a renewable encryption key, such that the data transmitted from or received by the base unit is encrypted for security and privacy. Separate encryption processes can be implemented for communications via both the wired network connections implemented via telephone line 232 or DSL line 245, and for wireless communications between base unit 100 and network devices 110 through 180. Moreover, encryption processes implemented for wireless communications between base unit 100 and network devices 110 through 180 may incorporate encryption keys based upon each device's unique device ID.

[0017]   Alternatively, microprocessor circuit 210 can implement a software analog modem to conduct data communications with a dial-up ISP through telephone line interface 230 and PSTN connection 232. While this implementation eliminates the need to purchase an expansion module for data communications, it limits the bandwidth available for communications between the base unit and the ISP and prohibits the use of PSTN line 232 for voice communications while data communications are taking place. However, off-line data processing techniques can minimize the resulting inconvenience, as is discussed further below.

[0018]   While base unit 100 comprises the hub of its own wireless network, in some circumstances a user may desire to provide an interface with a wireless networking

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standard in addition to that implemented by the base unit as described above. For example, expansion module 242 provides a wireless ethernet link based upon the IEEE 802.11 standard. Laptop computer 130 may be used during the day in an office that implements a wireless LAN based upon the 802.11 standard. By adding expansion module 242 to the user's home network, and configuring the module to operate as an 802.11 hub, the laptop computer can also be brought home and instantly connected to the user's home network, without requiring any cabling to base unit 100 or any other aspect of the user's home network. Alternatively, if a user implements a separate 802.11 network in their home that is connected to the Internet, expansion module 242 can be configured as a network client (rather than the hub). In this configuration, base unit 100 (and the other devices networked thereto) can access the connectivity of the 802.11 network via an 802.11 link through module 242. Moreover, by configuring wireless communications module 242 as an expansion module, modules implementing different or newer wireless communications protocols can also be provided, thereby allowing for expandability and upgradability of base unit 100.

[0019]   Expansion modules can also be incorporated into various independent electronic devices to provide such devices with a wireless interface to base unit 100 using the communications protocol implemented by cordless telephone handset 110. For example, personal computer 120 includes a transceiver card, with associated software drivers, that plugs into an industry standard PCI expansion slot and can provide an Internet Protocol ("IP") network connection via the cordless telephone communications link. Alternatively, personal computer 120 could include a stand-alone wireless modem implementing the wireless communications protocol of handset 110, connected via the

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USB bus or another external expansion port. Laptop computer 130 may be provided with a wireless connection to base unit 100 via one of the aforementioned techniques, or via a PCMCIA module, such as is commonly used for other laptop computer peripherals.

[0020]   A television set can also be incorporated into the home network by connecting it to a television appliance. Television appliance 140 includes an RF transceiver for communicating with base unit 100 via the cordless telephone communications protocol, as well as video display circuitry for visually displaying information received from base unit 100 on the television screen. A remote control device associated with the television appliance can be used for inputting text or commands, which can in turn be wirelessly transmitted to base unit 100 by appliance 140. Thus, appliance 140 can be used to provide a visual interface to base unit 100, and accordingly with other elements of the home network as well. For example, base unit 100 can provide a visual, menu-driven interface for programming base unit 100 by transmitting text and/or graphical data indicative of the base unit programming state to appliance 140, which data can then be displayed by appliance 140 on the television.

[0021]   An alternative display device that may comprise a part of a home network is portable display tablet 150. Tablet 150 includes a flat-panel LCD screen for information display, as well as a wireless transceiver implementing the cordless telephone protocol for communications with base unit 100. Tablet 150 may also include a touch-sensitive screen so that a stylus can be used as an input device, such as for the entry of text or the selection of displayed menu items.

[0022]   Display devices such as television appliance 140 and portable display tablet 150 can be utilized for the provision of email access or access to other Internet contents.

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In implementing email on such devices, base unit microprocessor circuit 210 can be provided with email client programming, such as POP3 and SMPT functionality known in the art. Storage for incoming and outgoing messages can be allocated within base unit memory 220 for various mailboxes.

[0023]   The cordless telephone communications protocol can also be utilized to provide a wireless connection with PDA 170. For example, many PDAs include expansion ports, such that a transceiver module and accompanying software could be connected to the PDA to provide a wireless data connection according to the cordless telephone communications protocol. Other PDAs may be designed specifically to include a wireless interface implementing the cordless telephone communications protocol. PDA 170 can therefore be used for functions such as providing a visual interface with base unit 100. PDA 170 can also implement a wireless Internet connection through base unit 100 and, for example, module 244, such as for web surfing or operation as an email client.

[0024]   Another advantage of the network disclosed herein is that cordless voice telephony can be conducted using devices that are not typically used therefor. For example, many PDAs include microphones and speakers or headphone jacks for audio input and output functionality. Such a PDA, equipped with the wireless data transceiver, can readily be utilized to implement voice telephony, in addition to its other functionality, merely via software implementation, thus eliminating the need to purchase additional hardware specifically for implementing voice telephony. Similarly, typical computers include microphone inputs as well as audio speakers. Thus, personal computer 120 and laptop computer 130 can also be used to conduct reliable, high-quality cordless voice telephony via the PSTN through base unit 100.

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[0025]   In addition to providing flexible voice telephony, base unit 100 also provides

real-time Internet connectivity to a wide array of network devices. Through its connection

with DSL line 245, IP networking can be wirelessly provided by base unit 100 to personal

computer 120, laptop computer 130, display tablet 150 or PDA 170. Television appliance

140 can also include IP networking features such that a television can be utilized as a web

browser display. Thus, the user can surf the web, shop, order groceries, check bank

accounts, or conduct any other Internet activity from a wide variety of locations within the

home.

[0026]   Another beneficial aspect of the illustrated embodiment of the wireless home

network is the ability to conduct cordless voice communications while simultaneously

executing data applications when base unit 100 includes a separate Internet connection in

addition to PSTN connection 232. For example, a user can speak with a merchant using

PDA 170 according to the cordless voice telephony features described above, while

simultaneously receiving graphical images of the merchant's products on portable display

tablet 150 via Internet connection 245, such as may assist in the user's purchase decision.

[0027]   Base unit 100 also implements off-line applications that do not require real-

time access to the Internet. Base unit 100 can operate as an off-line email client or

content client by periodically receiving incoming data or messages from, and periodically

transmitting outgoing data or messages to, intended destinations. Thus, incoming

messages and data is stored and can later be reviewed on a variety of devices connected

to the network, such as personal computer 120, laptop computer 130, television appliance

140, display tablet 150 or PDA 170. Likewise, outgoing email messages or other outgoing

data transmissions composed on one of the aforementioned network devices can be

stored by base unit 100 for later transmission. Offline functionality can be advantageously implemented, for example, when PSTN telephone line 232 is used for both voice communications and Internet connectivity. When a user finishes compiling outgoing email messages, or desires to check for new incoming email messages, base unit 100 can dial a service provider via software modem functionality and send/receive messages with minimal connection time, thereby leaving the telephone line otherwise free for regular voice telephony.

[0028]   Base unit 100 can also operate as a storage center for various home management data. For example, refrigerator 160 incorporates a display tablet operating substantially like that of tablet 150. Therefore, for example, when a user in the kitchen of a home notices that a particular item has been depleted, and needs to be purchased during a future shopping trip, the user can conveniently note the required item in a grocery list application via the refrigerator 160 display tablet. The grocery list entry is transmitted to base unit 100 via the cordless telephone communications protocol, and stored in base unit memory 220. In one potential embodiment, the cost of the display device can be minimized by implementing the device as a dumb terminal, such that the display device provides primarily input/output functionality, with data storage and processing occurring within base unit 100. Other network devices can also access the grocery list data within base unit 100, such that the list can be printed before a shopping trip by computer 120, or wirelessly downloaded into PDA 170. The user can also access the list while placing an order for required items via the Internet using an appropriate device on the home network, such as personal computer 120 or display tablet 150.

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[0029]   Base unit 100 can also collect and store desired information for display and

use by various network devices. For example, base unit 100 could collect weather

forecasts and/or stock quotes via Internet connection 245, for display on the display tablet

of refrigerator 160. Targeted advertising and/or discount promotions could also be

displayed on various network devices. For example, base unit 100 could be configured to

periodically poll Internet web sites specified by the user to check for sales or other

promotions in which the user may be interested. If such information is found, it is

transmitted to the display tablet in refrigerator 160 for display to the user. When PSTN

telephone line 232 is used to place data calls for information downloading, base unit 100

can be configured to call at times when the line is unlikely to be required for voice

telephony, such as at 4:00 a.m., thereby minimizing any inconvenience caused by

occupation of the telephone line.

[0030]   The aforementioned automated display of advertisements can also be

utilized to implement a business model based upon partial or complete subsidization of

user costs through automatic display of advertisements. Specifically, a service provider

could contract with various advertisers to advertise their products in the homes of users.

Users could then agree to have their base units configured to automatically display such

advertisements in return for reduced prices on network hardware and/or reduced rates for

various related services, such as Internet service provision.

[0031]   Base unit 100 may also include a dial-in function, whereby external access

to various aspects of the home network can be obtained. For example, a telephone call

can be placed to PSTN line 232, such that telephone line interface 230 answers the line.

Upon entry of a predetermined access code sequence of DTMF tones, microprocessor

circuit 210 may present the user with a voice menu that can be navigated via entries on a touch tone keypad. Through this mechanism, the user can check the status of various devices on the home network. For example, a home security system 180 may be configured with a cordless telephone transceiver and a device ID, such that it resides on the network. Base unit 100 can then query security system 180 to determine the alarm status, and convey commands to the security system to, for example, remotely arm or disarm the alarm. Alternatively, instead of providing dial-in access to the home network via the entry of DTMF tones, base unit 100 could detect modulated signals indicative of a modem data call on line 232, or data corresponding to a remote log in via Internet access line 245, such that a user could remotely control the base unit and other network devices via a remote computer interface.

[0032]   The foregoing description and drawings merely explain and illustrate the invention and the invention is not limited thereto except insofar as the appended claims are so limited, inasmuch as those skilled in the art, having the present disclosure before them will be able to make modifications and variations therein without departing from the scope of the invention.